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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

UTILITY APPLICATION AND APPLICATION FEE TRANSMITTAL (1.53(b))

COMMISSIONER FOR PATENTS
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Washington, D.C. 20231

Sir:

Transmitted herewith for filing is the patent application of

Named Inventor(s) and
Address(es):

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For: CAMERA CONTROL SYSTEM AND METHOD, AND STORAGE MEDIUM
Enclosed are:

[X] 25   page(s) of specification, _1_ page(s) of Abstract, 7 page(s) of claims

[X] 13   sheets of drawing   [X] formal   [ ] informal

[X] 7   Page(s) of Declaration and Power of Attorney

    [ ] Unsigned
    [X] Newly Executed
    [ ] Copy from prior application

        [ ] Deletion of inventors including Signed Statement under 37 C.F.R. § 1.63(d)(2)

[X]   Incorporation by Reference: The entire disclosure of the priority application(s) identified below, is considered as being part of the disclosure of the accompanying application and is incorporated herein by reference.

[ ]   Microfiche Computer Program (Appendix)

[ ]   _____ page(s) of Sequence Listing

    [ ]   computer readable disk containing Sequence Listing
    [ ]   Statement under 37 C.F.R. § 1.821(f) that computer and paper copies of the Sequence Listing are the same

[X]   Claim for Priority _Japanese Application No 11-272945 filed 9/27/99_

[ ]   Certified copy of Priority Document(s)

    [ ]   English translation documents

[ ]   Information Disclosure Statement

    [ ]   Copy of 1 Cited reference

    [ ]   Copy of PTO-1449 filed in parent application serial No._____.

[ ]   Preliminary Amendment

[X]   Return receipt postcard (MPEP 503)

[X]   Assignment Papers (assignment cover sheet and assignment documents)

    [X]   A check in the amount of $40.00 for recording the Assignment.

    [ ]   Assignment papers filed in parent application Serial No. _____.

    [ ]   Certification of chain of title pursuant to 37 C.F.R. § 3.73(b).

[ ]   This is a [ ] continuation [ ] divisional [ ] continuation-in-part (C-I-P) of prior application serial no. _____.

    [ ]   Cancel in this application original claims _____ of the parent application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

    [ ]   A preliminary Amendment is enclosed. (Claims added by this Amendment have been properly numbered consecutively beginning with the number following the highest numbered original claim in the prior application.

[ ]   The status of the parent application is as follows:

    [ ]   A Petition For Extension of Time and a Fee therefor has been or is being filed in the parent application to extend the term for action in the parent application until _____.

    [ ]   A copy of the Petition for Extension of Time in the co-pending parent application is attached.

    [ ]   No Petition For Extension of Time and Fee therefor are necessary in the co-pending parent application.

[ ]   Please abandon the parent application at a time while the parent application is pending or at a time when the petition for extension of time in that application is granted and while this application is pending has been granted a filing date, so as to make this application co-pending.

    [ ]   Transfer the drawing(s) from the patent application to this application.

[ ]   Amend the specification by inserting before the first line the sentence:
This is a [ ] continuation [ ] divisional [ ] continuation-in-part of co-pending application Serial No._____ filed _____.

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I.   CALCULATION OF APPLICATION FEE (For Other Than A Small Entity)

	Number Filed		Number Extra	Rate	Basic Fee $ 690.00
Total Claims	21	-20=	1	x$18.00	$ 18.00
Independent Claims	3	- 3=	0	x78.00	$ 0
Multiple Dependent Claims					
	[ ] yes		Additional Fee =		$ 0
	[X] no		Add'l Fee = 260.00	NONE	

Total: $708.00

[ ]   A statement claiming small entity status is attached or has been filed in the above-identified parent application and its benefit under 37 C.F.R. § 1.28(a) is hereby claimed. Reduced fees under 37 C.F.R. § 1.9(F) (50% of total) paid herewith $ _____.

[X]   A check in the amount of $708.00 for payment of the application filing fees is attached.

[ ]   Charge Fee(s) to Deposit Account No. 13-4500. Order No. _____. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

[X]   The Assistant Commissioner is hereby authorized to charge any additional fees which may be required for filing this application, or credit any overpayment to Deposit Account No. 13-4500, Order No. 1232-4649. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

Respectfully submitted,

MORGAN & FINNEGAN, L.L.P.

Dated: September 25, 2000

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Kazuko SUZUKI, Tomoaki KAWAI; and Kenji MORITA		
Serial No.	:	To Be Assigned	Examiner:	To Be Assigned
Filed	:	September 25, 2000 (Herewith)	Group Art Unit: TBA	
For	:	CAMERA CONTROL SYSTEM AND METHOD, AND STORAGE MEDIUM		

EXPRESS MAIL CERTIFICATE

Express Mail Label No. <u>EL020890907US</u>

Date of Deposit <u>September 25, 2000</u>

> I hereby certify that the following attached paper(s) and/or fee
> Application Fee Transmittal (in duplicate); 25 pp. of specs., 1 page of abstract, 7 pp claims (21 TOTAL claims); 7 pg. Executed Declaration/POA; 13 Sheets of Formal Drawings (Figs. 1-13); Check in the amount of $708.00 (filing fee); Assignment Recordation Form Cover Sheet; 2 pg Executed Assignment; Check in the amount of $40.00 (recordal fee); and return receipt postcard

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37

C.F.R. §1.10 on the date indicated above and is addressed to the Commissioner for Patents, Box New Applications,

Washington, D.C. 20231.

<div style="text-align: right;">

<u>Francisco J. Garcia</u>
Typed or printed name of person
mailing paper(s) and/or fee)

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TITLE OF THE INVENTION

CAMERA CONTROL SYSTEM AND METHOD,

AND STORAGE MEDIUM

5   FIELD OF THE INVENTION

The present invention relates to a camera control system and method capable of controlling one or more video cameras connected to a network, and a storage medium.

10 BACKGROUND OF THE INVENTION

A camera control system capable of remotely controlling one or a plurality of monitoring cameras from a remote place has conventionally been known. In this system, either each camera is fixed to a camera platform

15 to always direct to one direction, or its pan, tilt, and zoom can be externally controlled. The latter camera generally incorporates a function of remotely controlling the image sensing direction and magnification from a surveillance center.

20 In remotely controlling a plurality of cameras, the arrangement location and direction of each camera must be indicated to the operator. For example, the present applicant has already proposed a camera control system of displaying a graphic pattern (camera icon) representing a

25 camera at a position corresponding to the installation position of each camera superposed on the map of a shop,

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factory, or building in a surveillance system of installing
many cameras in the shop, factory, or building and remotely
controlling the cameras.

This camera control system requires a user interface
5   capable of various camera control operations by operating
a camera icon on a map with a pointing device such as a mouse.
For this purpose, the present applicant has also proposed
a method capable of controlling the direction and zoom of
a camera by displaying a graphic pattern representing the
10   image sensing range such as a current camera direction and
field angle superposed on a camera icon so as to manipulate
the graphic pattern with the mouse.

However, demands have arisen for further improvement
of the camera control function at a control terminal
15   operable by the user.

SUMMARY OF THE INVENTION

The present invention has been made to overcome the
conventional drawbacks, and has as its object to provide
20   a camera control system and method of further improving a
camera control function at a control terminal, and a storage
medium.

In order to solve the above problems and achieve the
above object, a camera control system of the present
25   invention is characterized by the following arrangement
according to its first aspect.

There is provided a camera control system for selecting at least one of a plurality of controllable cameras connected to a network, and performing video display and camera control, comprising map display means, input means for designating one point on a map displayed by said map display means, camera selection means for selecting an optimal camera capable of monitoring the point designated by said input means, and camera control means for controlling the camera selected by said camera selection means.

A camera control method of the present invention is characterized by the following process according to its first aspect.

There is provided a camera control method of selecting at least one of a plurality of controllable cameras connected to a network, and performing video display and camera driving, comprising the display step of displaying a map on a display, the designation step of designating one point on the map displayed in the display step, the camera selection step of selecting an optimal camera capable of monitoring the point designated in the designation step, and the driving step of driving the camera selected in the camera selection step.

A storage medium of the present invention is characterized by the following arrangement according to its first aspect.

There is provided a storage medium storing a control program of selecting at least one of a plurality of controllable cameras connected to a network, and performing video display and camera driving, wherein the control program comprises a code of the display step of displaying a map on a display, a code of the designation step of designating one point on the map displayed in the display step, a code of the camera selection step of selecting an optimal camera capable of monitoring the point designated in the designation step, and a code of the driving step of driving the camera selected in the camera selection step.

Other objects and advantages besides those discussed above shall be apparent to those skilled in the art from the description of a preferred embodiment of the invention which follows. In the description, reference is made to accompanying drawings, which form a part hereof, and which illustrate an example of the invention. Such example, however, is not exhaustive of the various embodiments of the invention, and therefore reference is made to the claims which follow the description for determining the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic block diagram showing the basic arrangement of a computer system according to the first embodiment of the present invention;

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Fig. 2 is a schematic block diagram showing a hardware arrangement in a network;

Fig. 3 is a schematic block diagram showing a software arrangement in the network;

Fig. 4 is a view showing an example of a camera display control panel displayed on a display by a camera control client;

Fig. 5 is a flow chart showing processing by the camera control client;

Fig. 6 is a table for explaining the structure and contents of an area table;

Fig. 7 is a flow chart showing processing by a camera control server;

Fig. 8 is a view showing a specific area region in a map window in the second embodiment;

Fig. 9 is a flow chart showing processing additionally executed in the second embodiment;

Fig. 10 is a flow chart showing a camera selection method;

Figs. 11A and 11B are tables for explaining the structure and contents of a camera state table managed by a camera management server;

Fig. 12 is a view for explaining the image sensing direction and a image sensing range θa (a, A); and

Fig. 13 is a flow chart showing area table setting processing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described in detail below with reference to the

5   accompanying drawings.

(First Embodiment)

Fig. 1 is a block diagram showing the schematic arrangement of a video communication terminal serving as a basic element, i.e., a computer system connected to a

10   plurality of cameras in the first embodiment of the present invention. One or more computers having the arrangement shown in Fig. 1 and/or one or more computers having a similar arrangement are connected to each other via a computer network.

15   In Fig. 1, reference numeral 10 (10-1, 10-2, 10-3,...) denote video cameras; 12 (12-1, 12-2, 12-3,...), camera control circuits for directly controlling the pan, tilt, zoom, focus adjustment, and stop value of the video cameras 10 (10-1, 10-2, 10-3,...) in accordance with

20   external control signals; and 14, a camera input selection device for selecting which of the video cameras 10 is to be controlled, and which of their output signals (in general, video signals, but video and audio signals for a camera with a microphone) is to be received. An example of a control

25   signal line is an RS-232C line, but the present invention is not limited to this.

Reference numeral 20 denotes a video communication terminal for sending a control command to a desired camera control circuit 12 via the camera input selection device 14 to control the video camera 10 corresponding to this camera control circuit 12, transmitting an image of a selected camera to the network, and receiving an image from the network; 22, a CPU for controlling the entire system; 24, a main storage; 26, a secondary storage (e.g., hard disk); 28, a mouse as a pointing device; and 30, a keyboard.

Reference numeral 32 denotes an I/O port connected to the camera input selection device 14 to supply a camera control command and the like to the camera input selection device 14; 34, a video board for receiving an output video signal from a video camera 10 selected by the camera input selection device 14, and displaying various images on a bitmap display 35; 36, a network interface for connecting the video communication terminal 20 to a computer network or communication network; and 38, a system bus for connecting the respective devices from the CPU 22 to the network interface 36 to each other. The network interface 36 can transmit a camera control signal from a remote place to the video communication terminal 20 via the network to control the video camera 10.

The camera input selection device 14 selects one of control signal lines connected to the camera control circuits 12 and one of video outputs, supplies the selected

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video output to the video board 34, and logically connects the selected control signal line to the I/O port 32. An example of the video signal format is a luminance/color difference separation type NTSC signal format. The video board 34 receives the video output selected by the camera input selection device 14. The received video signal is displayed as a moving picture in a predetermined window on the bitmap display 35, and/or transmitted to another device.

The secondary storage 26 stores various pieces of information about the camera 10 or another camera connected via the network, e.g., camera position information data and camera graphic pattern data. Details of these pieces of information will be described later.

When only one camera 10 is connected, the camera input selection device 14 can be omitted, and the camera control circuit 12 can be directly connected to the I/O port 32. When no image is transmitted, the camera 10, camera control circuit 12, and camera input selection device 14 can be omitted.

The apparatus shown in Fig. 1 is connected as a communication terminal to a network, as shown in Fig. 2. All the communication terminals need not have the same arrangement as that shown in Fig. 1. For example, the network may comprise a communication terminal connected to only one camera, or a terminal not connected to any camera

(i.e., a terminal having a function of only remotely controlling cameras connected to other terminals and displaying only an image from such cameras). In general, communication terminals having various arrangements

5   coexist in one network. Note that the network adopted in this embodiment assumes a LAN or WAN having a transmission bandwidth wide enough to transmit digital moving picture data and a camera control signal. Moving picture data is generally compressed and transmitted. This embodiment can

10   use various existing methods as a moving picture compression method, and a detailed description thereof will be omitted.

As described above, the video board 34 has a video capture function. The video board 34 supplies received

15   video data to the bitmap display 35 to display an image, and in addition supplies the received video data to the CPU 22 via the bus 38. The CPU 22 packetizes the video data, and outputs the packet to the network via the network interface 36. A camera manipulation instruction and

20   camera switching instruction are also packetized and transmitted to the network via the network interface 36. Information about the entire system is also packetized and transmitted to the network. These pieces of information are transmitted to a specific terminal or all terminals in

25   accordance with the contents of data to be transmitted if needed.

This also applies to reception. More specifically, when each video communication terminal 20 receives packetized video data, camera manipulation instruction, and camera switching instruction, the terminal 20 processes

5   the received video data like capture data, and processes the received camera manipulation instruction and camera switching instruction like internal similar instructions. Information about the entire system is used to update the system display of a user interface (to be described below).

10   Fig. 3 is a block diagram showing a software arrangement in the first embodiment. In Fig. 3, a plurality of video communication terminals 20 and a camera management server 50 are connected to a computer network 52. A camera control server 54 for controlling the camera

15   10 in accordance with a camera control signal (including a selection signal when a plurality of cameras are connected) input from a self terminal or transmitted from another terminal, a camera control client 56 for remotely controlling the camera 10 of the self terminal or another

20   terminal, and video transmission/reception software 58 for supplying an image from the camera of the self terminal to another terminal via the network 52, and supplying an image transferred from another terminal via the network 52 or an image from the camera 10 of the self terminal to the display

25   35 of the self terminal are installed in each video communication terminal 20.

The camera management server 50 is software for managing all cameras 10 released (or connected) to the network 52, and holds information such as the camera name, host name, installation position, and current status of each camera. The camera management server 50 manages registration of a camera newly usable via the network 52, and deletion along with disconnection from the network 52. In addition, the camera management server 50 informs all the camera control clients 56 of management information of each camera periodically or in accordance with a request. The camera management server 50 suffices to be stored in one of the terminals connected to the network 52.

The camera control client 56 displays the layout and directions of the camera 10 of the self terminal and all cameras usable via the network 52 by using predetermined camera symbols to be superposed on a map on the screen of the display 35 of the self terminal. The camera control client 56 updates the display state of each camera symbol in real time based on camera information periodically transmitted from the camera management server 50.

Fig. 4 is a view showing an example of a camera display control panel displayed on the display 35 by the camera control client 56. Reference numeral 60 denotes a map window for displaying a camera icon representing the installation position and direction of each camera superposed on a map showing the installation places of

controllable cameras; 62, a camera image window for displaying an image of one selected camera; and 64, a camera control panel which comprises various control buttons, and manipulates the pan, tilt, and zoom of a selected camera.

5   The first embodiment assumes that a window display system capable of simultaneously displaying a plurality of windows runs.

The map window 60 displays a map showing the seat layout of an office, and camera icons 66 representing the

10   locations of respective cameras deployed in the office are displayed on the map. Each camera icon 66 is displayed in almost the same direction as the current camera direction at a position corresponding to the installation location of the corresponding camera. The camera icons 66 are

15   displayed in different colors so as to identify a camera selected for video display or remote control, a camera used by another user, and a free camera.

The control panel 64 is displayed below the camera image window 62. The control panel 64 has two buttons, a

20   rotation button for pan and tilt, and a zoom button. By operating these buttons, an arbitrarily designated camera can be rotated and zoomed. If a selected camera cannot be operated (for example, the camera is being operated by another user), both the rotation button and zoom button

25   change to a control disable display state.

For example, when a user wants to access a certain

camera (in this case, remote control), the user double-clicks a camera icon representing this camera. Then, the camera control client 56 requests control of the camera of the camera management server 50. The camera

5   management server 50 checks whether control of that camera has already been given to another user by referring to a camera status list (to be described later). If control of the camera is not assigned to another user, the camera management server 50 permits remote control of the camera

10   (including video display as a matter of course); otherwise, denies control. If control is permitted, the camera image window 62 displays an output image from the camera to enable control (pan, tilt, and zoom) on the camera control panel 64.

15   Further, the first embodiment can select an optimal camera which can monitor a point on the map clicked (single-clicked in this embodiment) with a mouse, and control the camera so as to monitor the image at this point. For example, if the user clicks the mouse on the object of

20   a door 80, the nearest camera 90 is controlled to face the door, and the image of the camera image window 62 is switched to an image from the camera 90. At this time, the display of the camera icon is changed to enable the user to easily know the camera he or she is controlling. For example, the

25   camera icon is changed in color, or flickered for a predetermined time.

These operations are basically the same regardless
of which of objects displayed on the map is designated. The
present invention can select an optimal camera in
consideration of the three-dimensional camera layout,
5   image sensing range, camera use status, and the like. For
example, if the user clicks the mouse on the object of a
clock 81, a camera 92 at an optimal position for monitoring
the clock is selected. There are two cameras 90 and 91
nearer the clock 81 than the camera 92. However, the camera
10   90 is outside the maximum field angle (doted line in Fig. 4,
which is not displayed in practice), and cannot be actually
directed to face the clock. Compared to the camera 91, the
camera 92 can monitor the clock from its front side in terms
of the layout. Although not apparent from the map because
15   of two-dimensional display, the clock is hung high on the
wall. The camera 92 is controlled not only to pan toward
the clock 81 but also to tilt upward so as to clearly monitor
the clock 81. If the camera 92 is controlled by another
user, the camera 91 next optimal to monitor the clock 81
20   is selected. When the user clicks the mouse on the object
of a safe 82, the nearest camera is a camera 94, but the
camera 94 cannot monitor the safe 82 due to the presence
of a wall 83. Thus, the second nearest camera 93 is
controlled. Similarly, if the user clicks the icon of the
25   camera 90 with the mouse, the nearest camera 91 is selected,
and the user can see the status of the camera 90 (whether

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the camera 90 has broken or operates) from a remote place by an image from the camera 91.

Note that if the user clicks an area (e.g., 85) other than objects on the map with the mouse, no operation starts in the first embodiment.

Processing for realizing camera control upon clicking the mouse on the map will be explained with reference to Figs. 5 to 7.

Fig. 5 shows processing by the camera control client.

The camera control client checks in step S51 whether the mouse has been clicked once, and, if YES in step S51, determines in step S52 whether the mouse was clicked on the map window 60. If NO in step S52, the same processing as normal one is done, and a description thereof will be omitted. If YES in step S52, the camera control client shifts to step S53, and checks from the coordinate position whether the mouse was clicked in a predetermined area. In this embodiment, the predetermined area includes objects (e.g., the door 80, clock 81, safe 82, and camera 90) displayed on the map.

If YES in step S53, the camera control client determines a camera optimal for monitoring the area (object) and its camera parameters with reference to an area table (Step 54: Fig. 6; to be described later). The camera parameters are the pan, tilt, and zoom in the first embodiment, but are not limited to them. The camera

parameters may be only the pan and tilt, or a combination of the focus and exposure information may be additionally used. In step S55, the camera control client transmits, to a camera control server for controlling the camera, a

5   camera control request for controlling the camera to desired camera parameters. Then, the camera control client transmits a reception request command for the camera image to video transmission/reception software for transmitting the camera image.

10   Fig. 7 shows processing by the camera control server which has received the camera control request issued in step S55. The camera control server receives the camera control request in step S71, and executes camera control in step S72.

15   Fig. 6 shows details of the area table used in step S54. The area table is comprised of area numbers, camera IDs, and camera parameters. In the list of each area, an upper device has higher priority. For example, when the area 80 (i.e., door object 80) is designated on the map,

20   the camera 90 is first selected as a control candidate. As the camera parameters, (pan angle, tilt angle, zoom ratio) = (0, 10, 2) is selected. If the camera 90 is being controlled by another user, the second listed camera 92 is selected. If the camera 92 is being controlled by another

25   user, an error message such as "the camera cannot be controlled because it is being used by another user" is

displayed in a message region 90 in Fig. 4. Whether a camera is being controlled can be determined by an inquiry sent from the camera control client to the camera management server.

5   Fig. 13 shows an area table setting processing flow.

In this processing, a different table may be set for the camera control client of each video communication terminal. Alternatively, a privileged user (manager) of this surveillance system may set an area table at a specific

10   video communication terminal, and the set area table may be reflected on all camera control clients.

This processing can be set by switching a normal surveillance mode to a setting mode using the same user interface as that in Fig. 4. In the setting mode, camera

15   control or the like is temporarily locked to deny any other access.

In step S131, an area to be set is designated in the map window 60. If an area is partitioned for each object, the area is designated. Alternatively, a rectangular

20   frame which contains the object and has a minimum area may be designated with the mouse. In step S132, a camera which is to be moved when the area designated in step S131 is clicked with the mouse is selected. Then, the direction, field angle, and zoom of the camera can be controlled on

25   the control panel 64, and an image from the camera is displayed on the camera image window 62. The user controls

the camera so as to clearly monitor the area (object) (step

S133). After proper camera parameters are set, the user

clicks a "setting" button (not shown), and then the area

table is updated in step S134. This control (from step S132

5   to step S134) is performed in order of cameras to be actually

moved in the normal surveillance mode. Note that when a

camera whose camera parameters have been set once is clicked

again, the parameters of this camera in the area table are

rewritten.

10   Accordingly, the user interface as shown in Fig. 4

can be implemented by registering in advance camera

parameter information about a camera to be selected and its

direction and zoom ratio upon designating an object

displayed on the map.

15   (Second Embodiment)

In the first embodiment, when only a specific object

displayed on a map is designated, a corresponding camera

is selected and controlled. In the second embodiment, a

designated portion is not limited to an object. As shown

20   in Fig. 8, rectangular regions having various areas are set

as specific areas. When the mouse is clicked in such an

area, an optimal camera is selected and controlled so as

to photograph an object designated in advance in the

selected area.

25   For example, irrespective of the position in a vault

84 on the map which is clicked, a camera 93 can be immediately

directed to a safe 82 which most characterizes the vault.

(Third Embodiment)

In the first embodiment, if a region other than a specific area on a map is designated, like step S53 in Fig. 5,

5   no operation starts. This is effective when a person who manages a camera (camera manager) feels troublesome to determine cameras optimal for monitoring respective regions on a map and their camera parameters for any arbitrary coordinates with the mouse (because only partial

10   regions on the map suffice to be set).

However, some users want to direct a camera to a point (e.g., 85 in Fig. 4) where no object is displayed on the map and to see the image. In the third embodiment, this processing is compensated on the system side without

15   setting in advance any area table for all the coordinates on the map by the camera manager.

This embodiment is additionally executed when the mouse is determined in step S53 of Fig. 4 to be clicked outside a predetermined area. Only the additional

20   processing will be explained with reference to Figs. 9 to 12.

In step S91, a camera to be controlled is selected from a coordinate position clicked with the mouse on the map. In step S92, the moving amount of the camera to monitor

25   the clicked point is calculated. For example, a moving amount for directing the center of the camera to a direction

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in which the position clicked on the map and the camera

selected in step S91 are connected by a straight line is

calculated (if the moving amount exceeds the maximum pan

range, the zoom ratio is minimized). In step S93, the

5   calculated moving amount is transmitted as a camera control

command to the camera control server of the camera.

Fig. 10 is a flow chart showing a camera selection

method in step S91 of Fig. 9. In step S101, the distances

between a position ($\underline{a}$) clicked on the map and all camera

10   icon coordinates are calculated. In step S102, a camera

corresponding to an icon nearest to the position $\underline{a}$ is

selected as a candidate camera (camera x). In step S103,

whether the straight line which connects the position $\underline{a}$ and

camera x falls within the visible range (field range

15   obtained when the zoom ratio is minimized and the camera

is panned maximally) of the camera x is checked. At this

time, whether the position $\underline{a}$ cannot be seen from the camera

due to an obstacle such as a wall between $\underline{a}$ and x is also

checked. The visible range is obtained with reference to

20   Fig. 11A or 11B showing a camera state table integrally

managed by the camera management server.

Figs. 11A and 11B are tables showing the structure

and contents of the camera state table.

Figs. 11A and 11B show examples of the camera state

25   table which stores fixed information and variable

information of each camera. Fig. 11A shows a camera state

table for fixed information, and Fig. 11B shows a camera state table for storing the current value of variable information.

The camera state table shown in Fig. 11A includes the camera number, camera name, host name, camera installation position coordinates on the map, initial direction at the start, maximum zoom ratio, maximum field angle (field angle when the zoom ratio is minimized), and pannable direction θ_p ($p < \theta_p < P$) representing a pannable range. θ_p, p, and P are the angles with respect to the x direction (horizontal direction).

The camera state table shown in Fig. 11B has the camera number, current zoom ratio, current video field angle (obtained by referring to a correspondence table of the zoom ratio and video field angle using a current zoom ratio, as needed), current image sensing direction, and current image sensing range θ_a ($a < \theta_a < A$). The image sensing range θ_a can be calculated from the video field angle and the current image sensing direction. As shown in Fig. 12, letting α be the video field angle, and Φ be the current image sensing direction,

$$a = \Phi - \alpha/2$$
$$A = \Phi + \alpha/2$$

where a and A are the angles with respect to the x direction (horizontal direction).

Note that the camera management server integrally

manages information such as camera layout information, current direction, and field angle by using the camera state table as shown in Fig. 11A or 11B. Alternatively, the camera control server of the video communication terminal of a camera may manage the information in units of cameras.

Referring back to Fig. 10, if YES in step S103, whether the camera x is being controlled by another user is checked in step S104. If NO in step S103 or S104, the camera x cannot monitor the current point a, and the processing returns to step S102 to select the next candidate camera. In this case, a camera having the second shortest distance is selected as a candidate. Then, the processing shifts to step S105 to determine the camera.

The flow chart in Fig. 10 shows the processing method of selecting a camera icon nearest to the position a clicked with the mouse and controlling the camera. In addition to this processing, the step of checking whether a camera directed to the position a currently exists with reference to variable information of the camera in Fig. 11, and if a camera directed to the position a exists, shifting to step S105 to determine the camera as a candidate may be adopted as step S100 before step S101. If a camera directed to the position a exists, this step can omit the control time for calculating the distances of all cameras and the control time for directing a camera to the position a.

(Fourth Embodiment)

In the first embodiment, one camera optimal for
monitoring an area (object) is selected with reference to
the area table (Fig. 6) in step S54 of Fig. 5, and the camera
is controlled to display an image. In addition to the
5   arrangements of the first to third embodiments, the fourth
embodiment has a mode in which a plurality of cameras
capable of monitoring an object are selected, and all the
selected cameras are directed to a point clicked with the
mouse on a map. Switching of the mode is achieved by newly
10   adding a mode switching window on the display screen of
Fig. 4.

For example, when the user clicks the mouse on an
object 81 (clock) in a map window 60, the area table in Fig. 6
is referred to to issue a camera control request to the
15   camera control server so as to set predetermined camera
parameters in all cameras (in this case, cameras 92 and 91)
registered for the object 81. In this case, a camera image
window 62 in Fig. 4 can display a plurality of images. This
arrangement can control a plurality of cameras by only one
20   object designation, and confirm an object from various
angles.

As is apparent from the above description, the above
embodiments can control a camera to actually monitor an
object on a map designated with a mouse. At this time, a
25   camera optimal for monitoring the object and its camera
parameters can be set with a simple user interface. If this

- 23 -

camera is being controlled by another user, the next candidate camera is selected to monitor the point.

Even when the user clicks with the mouse not only an object but also a given region (area) on the map, a camera optimal for monitoring the area can be selected to monitor the state of the area.

If the user clicks with the mouse an area other than a predetermined area on the map, no operation starts.

Moreover, even if the user clicks with the mouse an area other than a predetermined area on the map, the nearest camera capable of image sensing the designated point can be selected and directed to the point without setting an optimal camera and its camera parameters.

When the user clicks a predetermined area on the map with the mouse, a plurality of cameras can monitor the point.

The object of the present invention is realized even by supplying a storage medium (or recording medium) storing software program codes for realizing the functions of the above-described embodiments to a system or apparatus, and causing the computer (or a CPU or MPU) of the system or apparatus to read out and execute the program codes stored in the storage medium. In this case, the program codes read out from the storage medium realize the functions of the above-described embodiments by themselves, and the storage medium storing the program codes constitutes the present

invention. The functions of the above-described embodiments are realized not only when the readout program codes are executed by the computer but also when the operating system (OS) running on the computer performs part or all of

5   actual processing on the basis of the instructions of the program codes.

The functions of the above-described embodiments are also realized when the program codes read out from the storage medium are written in the memory of a function expansion card

10   inserted into the computer or a function expansion unit connected to the computer, and the CPU of the function expansion card or function expansion unit performs part or all of actual processing on the basis of the instructions of the program codes.

15   When the present invention is applied to the above storage medium, the storage medium stores program codes corresponding to the above-described flow charts (shown in Figs. 5, 7, 9, 10, and 13).

As has been described above, the present invention

20   can improve the camera control operability on a map.

The present invention is not limited to the above embodiments and various changes and modifications can be made within the spirit and scope of the present invention. Therefore, to apprise the public of the scope of the present

25   invention the following claims are made.

WHAT IS CLAIMED IS:

1.   A camera control system for selecting at least one of a plurality of controllable cameras connected to a network, and performing video display and camera control, the system comprising:

        map display means;

        input means for designating one point on a map displayed by said map display means;

        camera selection means for selecting an optimal camera capable of monitoring the point designated by said input means; and

        camera control means for controlling the camera selected by said camera selection means.

2.   The system according to claim 1, further comprising:

        storage means for storing information which determines a camera and a camera parameter in advance for each object displayed on the map, and

        wherein said camera selection means selects a camera on the basis of the information stored in said storage means.

3.   The system according to claim 1, further comprising:

        storage means for storing information which determines a camera and a camera parameter in advance for each specific region on the map, and

        wherein said camera selection means selects a camera on the basis of the information stored in said storage

means.

4.   The system according to claim 1, wherein said camera
selection means comprises determination means for
determining whether a camera as a selection candidate is
5   being controlled by another user, and selects another
camera when the camera as the selection candidate is
determined to be controlled by another user.

5.   The system according to claim 1, wherein when a point
other than a specific region on the map is designated by
10   said input means, said camera selection means does not
select any camera.

6.   The system according to claim 1, wherein said camera
selection means comprises calculation means for
calculating distances between the point input by said input
15   means and the plurality of cameras, and selects based on
a calculation result of said calculation means the nearest
camera capable of sensing an image of the designated point.

7.   The system according to claim 1, further comprising:
          holding means for holding information about current
20   image sensing ranges of the plurality of cameras; and
          determination means for determining based on the
information held by said holding means whether a camera
currently sensing an image of the point designated by said
input means exists, and
25   wherein said selection means selects the camera which
is determined by said determination means to be currently

sensing the image of the designated point.

8.   The system according to claim 1, wherein

said camera selection means can select a plurality

of cameras capable of sensing an image of one point input

by said input means, and

said camera control means controls the plurality of

cameras to the point input by said input means.

9.   The system according to claim 1, further comprising:

setting means for setting a camera to be controlled

and a camera parameter in accordance with the point

designated on the map; and

storage means for storing information about the

camera and the camera parameter that are set by said setting

means.

10.   A camera control method of selecting at least one of

a plurality of controllable cameras connected to a network,

and performing video display and camera driving, the method

comprising:

the display step of displaying a map on a display;

the designation step of designating one point on the

map displayed in the display step;

the camera selection step of selecting an optimal

camera capable of monitoring the point designated in the

designation step; and

the driving step of driving the camera selected in

the camera selection step.

11.   The method according to claim 10, further comprising:

the storage step of storing information which determines a camera and a camera parameter in advance for each object displayed on the map, and

5   wherein the camera selection step comprises selecting a camera on the basis of the information stored in the storage step.

12.   The method according to claim 10, further comprising:

the storage step of storing information which

10   determines a camera and a camera parameter in advance for each specific region on the map, and

wherein the camera selection step comprises selecting a camera on the basis of the information stored in the storage step.

15   13.   The method according to claim 10, wherein the camera selection step comprises the determination step of determining whether a camera as a selection candidate is being controlled by another user, and comprises selecting another camera when the camera as the selection candidate

20   is determined to be controlled by another user.

14.   The method according to claim 10, wherein the camera selection step comprises, when a point other than a specific region on the map is designated in the designation step, not selecting any camera.

25   15.   The method according to claim 10, wherein the camera selection step comprises the calculation step of

calculating distances between one point designated in the

designation step and the plurality of cameras, and

comprises selecting based on a calculation result in the

calculation step the nearest camera capable of sensing an

5   image of the designated point.

16.   The method according to claim 10, further comprising:

the holding step of holding information about current

image sensing ranges of the plurality of cameras; and

the determination step of determining based on the

10   information held in the holding step whether a camera

currently sensing an image of the point designated in the

designation step exists, and

wherein selection step comprises selecting the

camera which is determined in the determination step to be

15   currently sensing image of the designated point.

17.   The method according to claim 10, wherein

the camera selection step comprises selecting a

plurality of cameras capable of sensing an image of the

point designated in the designation step, and

20   the driving step comprises controlling the plurality

of cameras to the point input in the designation step.

18.   The method according to claim 10, further comprising:

the setting step of setting a camera to be driven and

a camera parameter in accordance with the point designated

25   on the map; and

the storage step of storing information about the

camera and the camera parameter that are set in the setting
step.

19. A storage medium storing a control program of
selecting at least one of a plurality of controllable
cameras connected to a network, and performing video
display and camera driving, wherein

the control program comprises:

a code of the display step of displaying a map on a
display;

a code of the designation step of designating one
point on the map displayed in the display step;

a code of the camera selection step of selecting an
optimal camera capable of monitoring the point designated
in the designation step; and

a code of the driving step of driving the camera
selected in the camera selection step.

20. The medium according to claim 19, wherein

the code of the camera selection step comprises
selecting a plurality of cameras capable of sensing an image
of the point designated in the designation step; and

the code of the driving step comprises controlling
the plurality of cameras to the one point input in the
designation step.

21. The medium according to claim 19, wherein the control
program further comprises:

a code of the setting step of setting a camera to be

driven and a camera parameter in accordance with the point
designated on the map; and

a code of the storage step of storing information
about the camera and the camera parameter that are set in

5   the setting step.

ABSTRACT OF THE DISCLOSURE

An object of this invention is to provide a camera
control system for improving a camera control function at
a control terminal. To achieve this object, a camera
5   control system for selecting one or more cameras from a
plurality of controllable cameras connected to a network,
and performing video display and camera control includes
a map display monitor, a mouse for designating one point
on a map displayed by the monitor, a camera selection unit
10   for selecting an optimal camera capable of monitoring the
point designated by the mouse, and a camera control unit
for controlling the camera selected by the camera selection
unit.

F I G. 1

F I G. 2

F I G. 3

FIG. 4

CAMERA IMAGE WINDOW 62

64

ZOOM

(MESSAGE REGION) 90

60 MAP WINDOW

84 VAULT

82 SAFE

83

94

85

81 CLOCK

66

93

91

92

SHELF

TABLE

90

80 DOOR

FIG. 5

```
                    ┌─────────┐
                    │  START  │
                    └────┬────┘
                         │
                         ▼
  S51 ╲           ╱──────────────╲
          ╱   MOUSE   ╲        NO
       ╱   CLICKED     ╲──────────────┐
       ╲    ONCE ?    ╱               │
          ╲──────────╱                │
               │ YES                  │
               ▼                      │
  S52 ╲   ╱──────────────╲            │
       ╱                  ╲    NO      │
       ╲     ON MAP ?     ╱───────────┤
          ╲──────────────╱            │
               │ YES                  │
               ▼                      │
  S53 ╲   ╱──────────────╲            │
       ╱       IN         ╲   NO       │
       ╱  PREDETERMINED    ╲──────────┤
       ╲     AREA ?       ╱            │
          ╲──────────────╱            │
               │ YES                  │
               ▼                      │
  S54 ┌─────────────────────────┐     │
      │ DETERMINE OPTIMAL CAMERA │     │
      │   AND CAMERA PARAMETER   │     │
      └────────────┬────────────┘     │
                   ▼                  │
  S55 ┌─────────────────────────┐     │
      │  TRANSMIT CAMERA CONTROL │     │
      │         REQUEST          │     │
      └────────────┬────────────┘     │
                   │                  │
                   ◄──────────────────┘
                   ▼
               ┌─────────┐
               │   END   │
               └─────────┘
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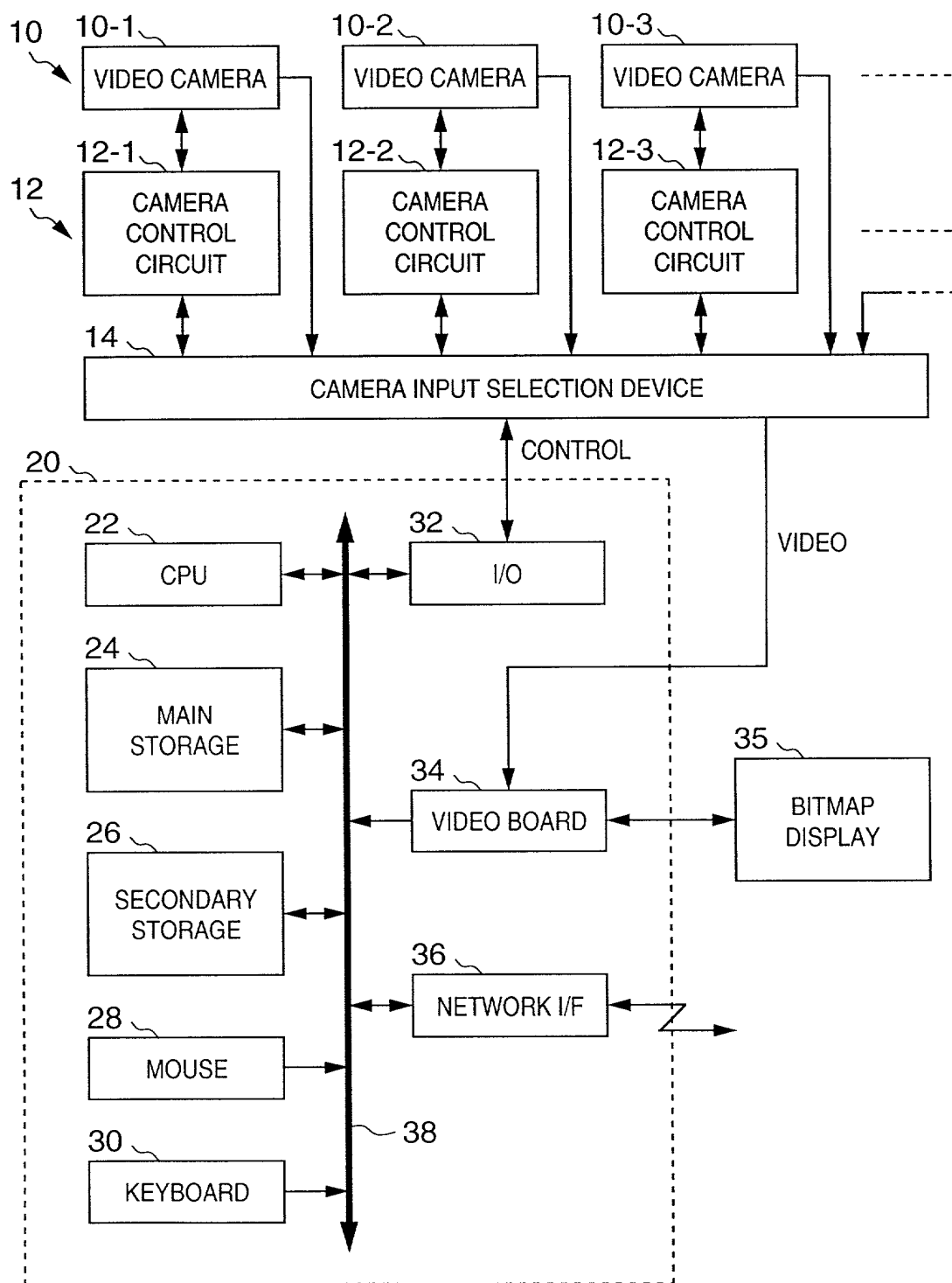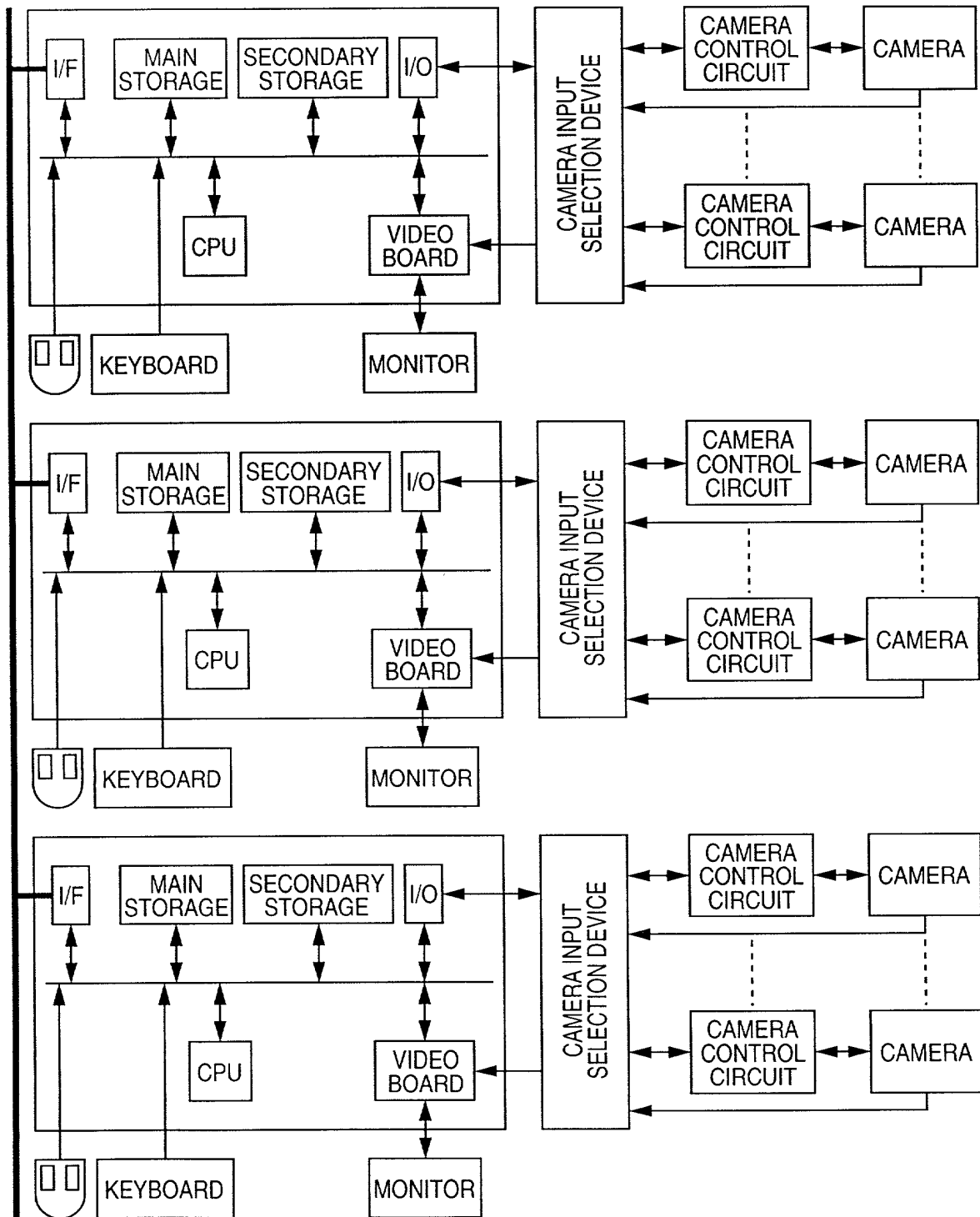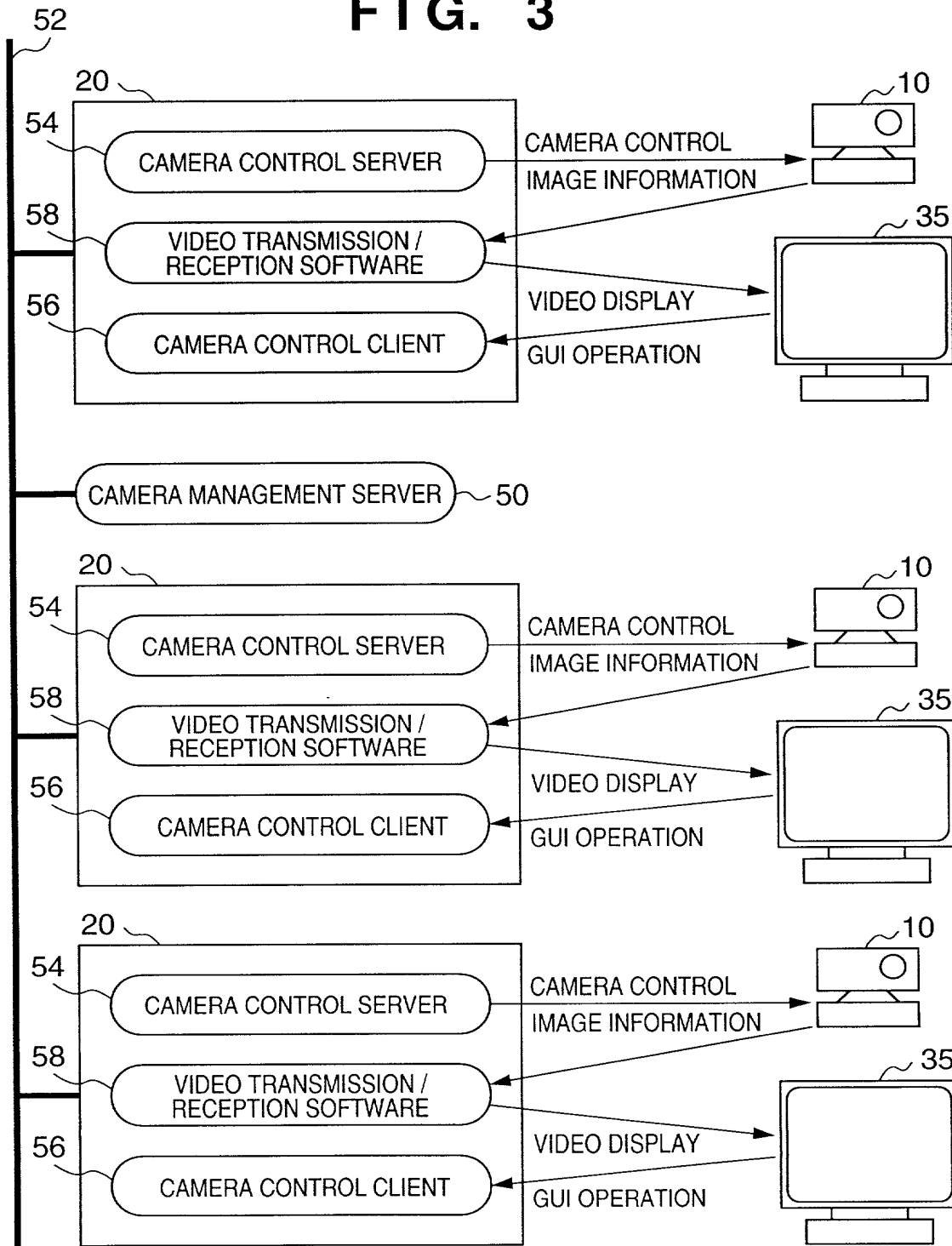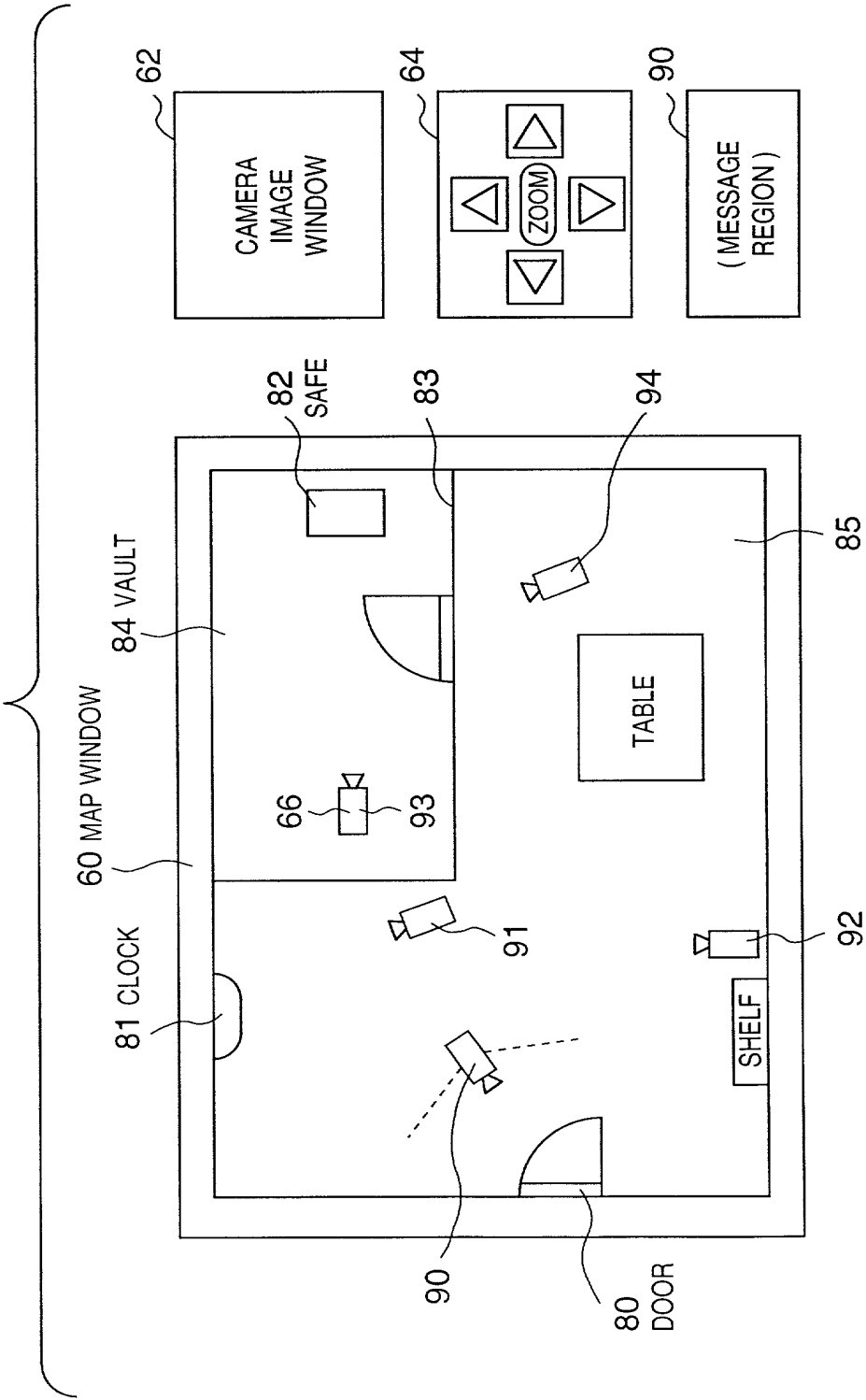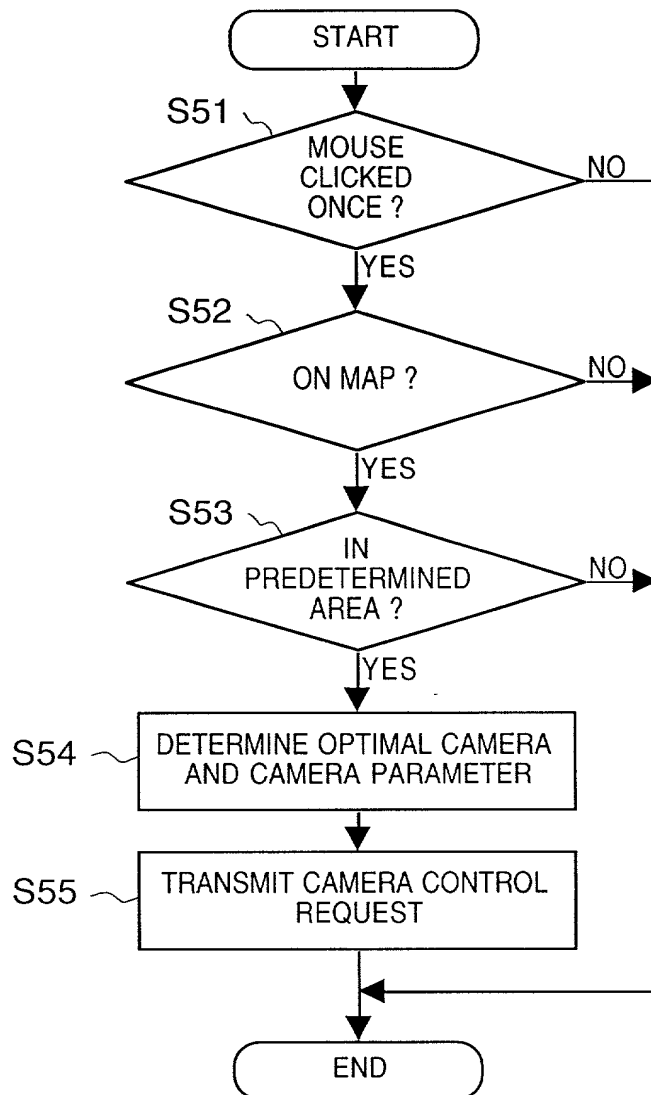
F I G. 6

AREA TABLE

AREA	CAMERA ID	CAMERA PARAMETER (P, T, Z)
80	90	(0, 10, 2)
	92	(−45, −10, 4)
81	92	(0, 25, 8)
	91	(60, 30, 3)
82	93	(−10, 0, 2)
90	91	(−8, 0, 1)
	92	(−10, 10, 3)

F I G. 7

```
        ┌─────────────┐
        │    START    │
        └──────┬──────┘
               ▼
┌────────────────────────────────┐
│ RECEIVE CAMERA CONTROL REQUEST │
└────────────────┬───────────────┘
                 ▼
┌────────────────────────────────┐
│        CONTROL CAMERA          │
└────────────────┬───────────────┘
                 ▼
        ┌─────────────┐
        │     END     │
        └─────────────┘
```

F I G. 8

F I G. 9

```
            ┌─────────────┐
            │    START    │
            └──────┬──────┘
                   │
                   ▼
S91  ┌─────────────────────────────────┐
     │     SELECT CANDIDATE CAMERA      │
     └─────────────────┬───────────────┘
                       │
                       ▼
S92  ┌─────────────────────────────────┐
     │   CALCULATE CAMERA MOVING AMOUNT │
     └─────────────────┬───────────────┘
                       │
                       ▼
S93  ┌─────────────────────────────────┐
     │   TRANSMIT CAMERA CONTROL COMMAND│
     └─────────────────┬───────────────┘
                       │
                       ▼
            ┌─────────────┐
            │     END     │
            └─────────────┘
```

F I G. 10

```
                    ┌─────────────┐
                    │    START    │
                    └─────────────┘
                           │
                           ▼
S101 ──┌──────────────────────────────────────┐
       │   CALCULATE DISTANCES OF ALL CAMERAS  │
       └──────────────────────────────────────┘
                           │
                           ▼
S102 ──┌──────────────────────────────────────┐
       │           CANDIDATE CAMERA            │
       └──────────────────────────────────────┘
                           │
       S103                ▼
              ╱─────────────────────╲
             ╱         WITHIN         ╲    NO
             ╲        VISIBLE         ╱ ──────►
              ╲       RANGE ?        ╱
               ╲─────────────────────╱
                           │ YES
       S104                ▼
              ╱─────────────────────╲   NO
             ╱     DURING CONTROL ?   ╲ ──────►
              ╲─────────────────────╱
                           │ YES
S105 ──┌──────────────────────────────────────┐
       │           DETERMINE CAMERA            │
       └──────────────────────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │     END     │
                    └─────────────┘
```
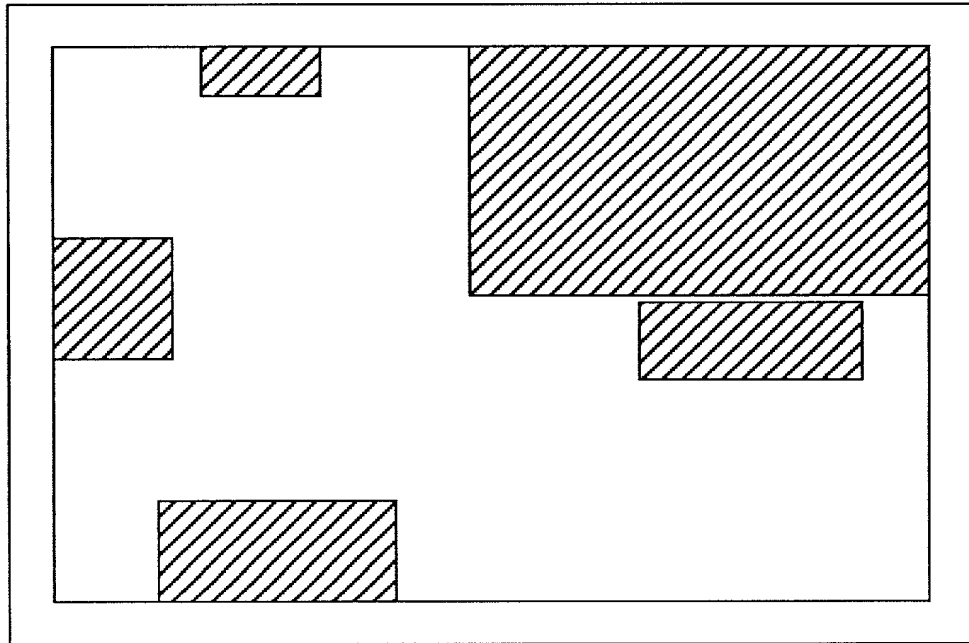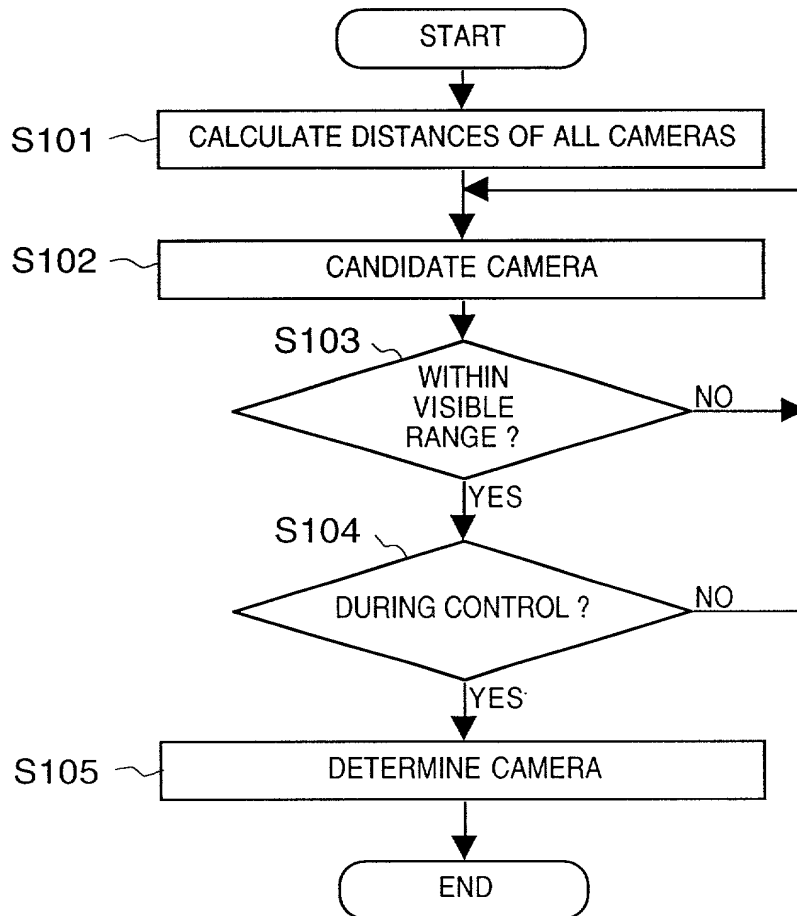
FIG. 11A

FIXED INFORMATION

CAMERA NUMBER	CAMERA NAME	HOST NAME	INSTALLATION POSITION	INITIAL DIRECTION	MAXIMUM ZOOM RATIO	MAXIMUM FIELD ANGLE	PANNABLE DIRECTION
1	camera1	host1	(150, 11)	180	8.0	120	(120, 240)
2	camera2	-------	-------	-------	-------	-------	-------

FIG. 11B

VARIABLE INFORMATION

CAMERA NUMBER	ZOOM RATIO	VIDEO FIELD ANGLE	CURRENT IMAGE SENSING DIRECTION	IMAGE SENSING RANGE	DURING CAMERA CONTROL
1	3.0	40	145	(125, 165)	Y
2	-------	-------	-------	-------	N

F I G. 12

X

CAMERA i

a

A

CURRENT
IMAGE SENSING
DIRECTION φ

α

IMAGE SENSING
RANGE

F I G. 13

```
            ┌─────────────┐
            │    START    │◄──────────────────┐
            └──────┬──────┘                    │
                   ▼                           │
S131 ─┐   ┌─────────────────┐                 │
      └─  │ DESIGNATE AREA  │◄────────────┐   │
          └────────┬────────┘             │   │
                   ▼                      │   │
S132 ─┐   ┌─────────────────┐             │   │
      └─  │  SELECT CAMERA  │             │   │
          └────────┬────────┘             │   │
                   ▼                      │   │
S133 ─┐   ┌─────────────────────┐         │   │
      └─  │ SET CAMERA PARAMETER │        │   │
          └──────────┬──────────┘         │   │
                     ▼                    │   │
S134 ─┐   ┌─────────────────────┐         │   │
      └─  │  UPDATE AREA TABLE   │        │   │
          └──────────┬──────────┘         │   │
                     ▼                    │   │
S135 ─┐       ◆◆◆◆◆◆◆◆◆◆◆◆◆               │   │
      └─   ◆◆  ALL DESIRED  ◆◆  NO         │   │
           ◆◆   CAMERAS ?   ◆◆────────────┘   │
              ◆◆◆◆◆◆◆◆◆◆◆◆◆                   │
                     │ YES                     │
                     ▼                         │
S136 ─┐       ◆◆◆◆◆◆◆◆◆◆◆◆◆                   │
      └─   ◆◆              ◆◆  NO              │
           ◆◆  ALL AREAS ? ◆◆─────────────────┘
              ◆◆◆◆◆◆◆◆◆◆◆◆◆
                     │ YES
                     ▼
            ┌─────────────┐
            │     END     │
            └─────────────┘
```
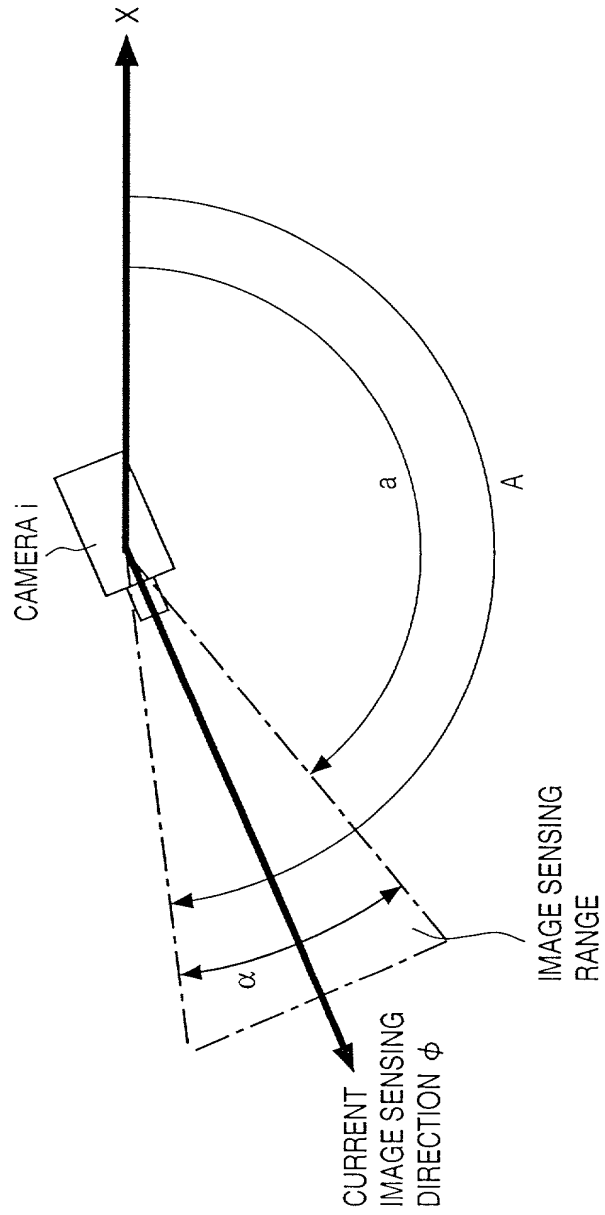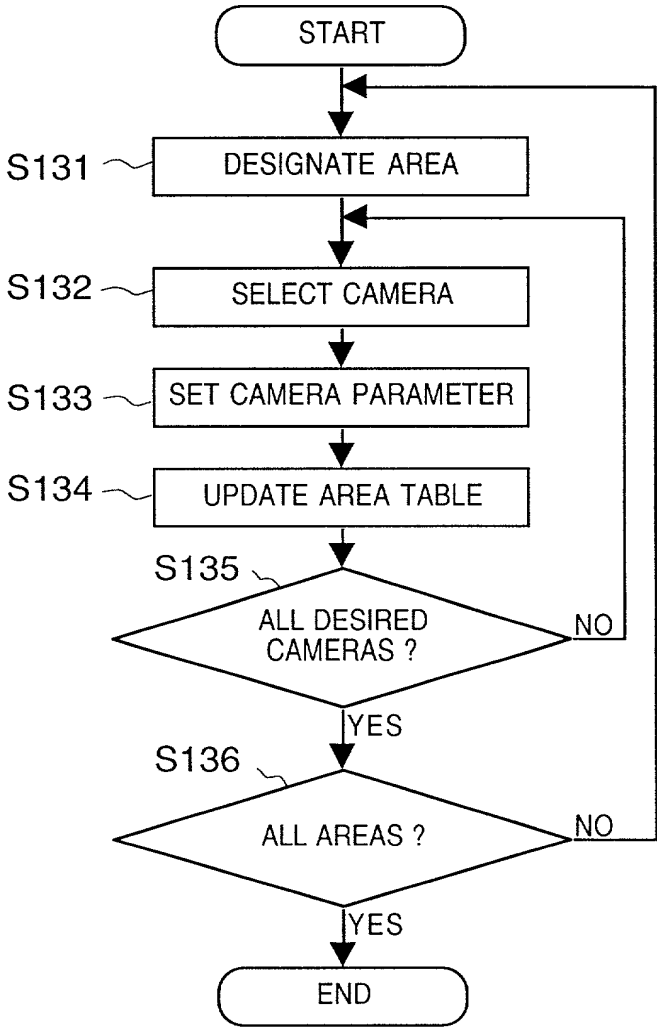
COMBINED DECLARATION AND POWER OF ATTORNEY FOR
ORIGINAL , DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL,
DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

CAMERA CONTROL SYSTEM AND METHOD, AND STORAGE MEDIUM

the specification of which

        a. [X] is attached hereto

        b. [   ] was filed on _____ as application Serial No. _____ and
             was amended on _____(if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

        C. [   ] was described and claimed in International Application No._____filed on
        _____and as amended on _____.(if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby specify the following as the correspondence address to which all communications about this application are to be directed:

        SEND CORRESPONDENCE TO: MORGAN & FINNEGAN, L.L.P.
                                345 Park Avenue
                                New York, N.Y. 10154

        DIRECT TELEPHONE CALLS TO: Michael M. Murray_____
        (212) 758-4800

        [X] I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or under § 365(b) of any foreign application(s) for patent or inventor's certificate or under § 365(a) of any PCT international application(s) designating at least one country other than the U.S. listed below and also have identified below such foreign application(s) for patent or inventor's certificate or such PCT international application(s) filed by me on the same subject matter having a filing date within twelve (12) months before that of the application on which priority is claimed:

        [X] The attached 35 U.S.C. § 119 claim for priority for the U.S. application(s) listed below forms a part of this declaration.

351265_1

Docket No. _____

Country/PCT	Application Number	Date of filing (day,month,yr)	Date of issue (day,month,yr)	Priority Claimed
JAPAN	11-272945	27/09/99		[X]YES [ ]NO
				[ ]YES [ ]NO

[ ] I hereby claim the benefit under 35 U.S.C. § 119(e) of any U.S. provisional application(s) listed below.

Provisional Application No.	Date of filing (day, month, yr)

ADDITIONAL STATEMENTS FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART OR PCT INTERNATIONAL APPLICATION(S DESIGNATING THE U.S.)

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or under § 365(c) of any PCT international application(s) designating the U.S. listed below.

US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)

US/PCT Application Serial No.	Filing Date,	Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)

[ ] In this continuation-in-part application, insofar as the subject matter of any of the claims of this application is not disclosed in the above listed prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys and/or agents with full power of substitution and revocation, to prosecute this application, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith: John A. Diaz (Reg. No. 19,550), John C. Vassil (Reg. No. 19,098), Alfred P. Ewert (Reg. No. 19,887), David H. Pfeffer, P.C. (Reg. No. 19,825), Harry C. Marcus (Reg. No. 22,390), Robert E. Paulson (Reg. No. 21,046), Stephen R. Smith (Reg. No. 22,615), Kurt E. Richter (Reg. No. 24,052), J. Robert Dailey (Reg. No. 27,434), Eugene Moroz (Reg. No. 25,237), John F. Sweeney (Reg. No. 27,471), Arnold I. Rady (Reg. No. 26,601), Christopher A. Hughes (Reg. No. 26,914), William S. Feiler (Reg. No. 26,728), Joseph A.Calvaruso (Reg. No. 28,287), James W. Gould (Reg. No. 28,859), Richard C. Komson (Reg. No. 27,913), Israel Blum (Reg. No. 26,710), Bartholomew Verdirame (Reg. No. 28,483), Maria C. H. Lin (Reg. No. 29,323), Joseph A. DeGirolamo (Reg. No. 28,595), Michael A. Nicodema (Ref. No. 33,199), Michael P. Dougherty (Ref. No. 32,730), Seth J. Altas (Reg. No. 32,454), Andrew M.

351265_1

Docket No. _____

Riddles (Reg. No. 31,657), Bruce D. DeRenzi (Reg. No. 33,676), Michael M. Murray (Reg. No. 32,537) and Mark J. Abate (Reg. No. 32,527) of Morgan & Finnegan, L.L.P. whose address is: 345 Park Avenue, New York, New York 10154; and Edward A. Pennington (Reg. No. 32,588) of Morgan & Finnegan, L.L.P., whose address is: 1299 Pennsylvania Avenue, N.W., Suite 960, Washington, D.C. 20004.

[ ]   I hereby authorize the U.S. attorneys and/or agents named hereinabove to accept and follow instructions from _____
_____ as to any
action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and/or agents and me. In the event of a change in the person(s) from whom instructions may be taken I will so notify the U.S. attorneys and /or agents named hereinabove.

Full name of sole or first inventor_____Kazuko SUZUKI_____

Inventor's signature*_____*Kazuko Suzuki*_____
                    14-10-308, Shinyokohama   date
Residence_____2-chome, Kohoku-ku, Yokohama-shi, Kanagawa-ken, Japan_____

Citizenship_____Japan_____
                    c/o Canon Kabushiki Kaisha
Post Office Address_____30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan_____

Full name of second joint inventor, if any_____Tomoaki KAWAI_____

Inventor's signature*_____*Tomoaki Kawai*_____
                    13-2-420, Osone 3-chome,   date   *September 19, 2000*
Residence_____Kohoku-ku, Yokohama-shi, Kanagawa-ken, Japan_____

Citizenship_____Japan_____
                    c/o Canon Kabushiki Kaisha
Post Office Address_____30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan_____

[X]   ATTACHED IS ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY
         FOR SIGNATURE BY THIRD AND SUBSEQUENT INVENTORS FORM.

* Before signing this declaration, each person signing must:

    1.   Review the declaration and verify the correctness of all information therein; and

    2.   Review the specification and the claims, including any amendments made to the claims.

After the declaration is signed, the specification and claims are not to be altered.

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Docket No. _____

Full name of third joint inventor, if any_____ Kenji MORITA _____

Inventor's signature*___*Kenji Morita*_____

Residence___8-27-104, Tsunashimahigashi date September 21, 2000_____
___4-chome, Kohoku-ku, Yokohama-shi, Kanagawa-ken, Japan____

Citizenship___Japan_____

Post Office Address___c/o Canon Kabushiki Kaisha
___30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan___

Full name of fourth joint inventor, if any_____

Inventor's signature*_____
                                        date

Residence_____

Citizenship_____

Post Office Address_____

Full name of fifth joint inventor, if any_____

Inventor's signature*_____
                                        date

Residence_____

Citizenship___Japan_____

Post Office Address_____

Full name of sixth joint inventor, if any_____

Inventor's signature*_____
                                        date

Residence_____

Citizenship_____

Post Office Address_____

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To the inventor(s):

The following are cited in or pertinent to the declaration attached to the accompanying application:

Title 37, Code of Federal Regulation, § 1.56

Duty to disclose information material to patentability.

(a)   A patent by its very nature is affect with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1)   prior art cited in search reports of a foreign patent office in a counterpart application, and

(2)   the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

Title 35, U.S. Code § 101

Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Title 35 U.S. Code § 102

Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless --

(a)   the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent,

(b)   the invention was patented or described in a printed publication in this or foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States, or

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(c)   he has abandoned the invention, or

(d)   the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate field more than twelve months before the filing of the application in the United States, or

(e)   the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or

(f)   he did not himself invent the subject matter sought to be patented, or

(g)   before the applicant's invention thereof the invention was made in this country by another had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other ...

Title 35, U.S. Code § 103

Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Title 35, U.S. Code § 112 (in part)

Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms also enable any person skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Title 35, U.S. Code § 119

Benefit of earlier filing date in foreign country; right of priority

An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such

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foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of he actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing.

Title 35, U.S. Code § 120

Benefit or earlier filing date in the United States

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, which is filed by an inventor or inventors named in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

Please read carefully before signing the Declaration attached to the accompanying Application.

If you have any questions, please contact Morgan & Finnegan, L.L.P.

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Rev. 5/21/98

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